

THIRD SEMESTER UG INTERNAL EXAMINATION, SEPTEMBER 2025

Major Course in Mathematics

MAT3CJ201 – MULTIVARIABLE CALCULUS

Malabar Christian College, Calicut

Time : One Hour

Maximum: 35 Marks

Name:	Marks Scored	Section A		Total Marks
Class:		Section B		
		Section C		

Section A

(Each question carries 3 marks, Maximum marks for section - 7)

- Find a spherical coordinate equation for the sphere  $x^2 + y^2 + (z - 1)^2 = 1$ .
- Find the Domain and Range of  $w = \sqrt{y - x^2}$ .
- Define continuity of a function  $f(x,y)$  at a point.

Section B

(Each question carries 6 marks, Maximum marks for section - 18)

- Using the definition, find the derivative of  $f(x, y) = 2xy - 3y^2$  at  $P_0(5,5)$  in the direction of  $A = 4i + 3j$ .
- Find the distance from  $S(1,1,3)$  to the plane  $3x + 2y + 6z = 6$ .
- Show that the function  $f(x, y) = \frac{2x^2y}{x^4 + y^2}$  has no limit as  $(x,y)$  approaches  $(0,0)$ .
- Find  $\frac{\partial w}{\partial r}$  and  $\frac{\partial w}{\partial s}$  for the function  $w = x^2 + y^2$ ,  $x = r - s$ ,  $y = r + s$ .

Section C

(Answer any 1 Question, each question carries 10 marks)

- Find equations for tangent plane and normal line to the surface  $x^2 + 2xy - y^2 + z^2 = 7$  at the point  $P_0(1, -1, 3)$ .
  - Graph i)  $r \leq 0$  and  $\theta = \frac{\pi}{4}$     ii)  $\frac{\pi}{4} \leq \theta \leq \frac{3\pi}{4}$ ,  $0 \leq r \leq 1$ .
- State Euler's mixed Derivative theorem and verify for the function  $w = xy + \frac{e^y}{y^2 + 1}$ .
  - Find the Linearization of  $f(x, y) = x^2 - xy + \frac{1}{2}y^2 + 3$ .
    - Find the upper bound for the error in the approximation  $f(x, y) \approx L(x, y)$  over the rectangle  $R: |x - 3| \leq 0.1, |y - 2| \leq 0.1$ .